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AUTHOR Tamm, Maare
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ABSTRACT

An experiment was conducted to test the hypothesis (derived from Piaget's theory of cognitive development) that the structure of children's drawings and play-constructions, being expressions of the same underlying function, should be similar. Two groups of 4- and 6-year-old nursery school children were given a testing task consisting of an orally presented narrative describing an outdoor scene. Following this presentation, children were required to retell the story and, in separate sessions, to produce a drawing, build with toys they had to request, and build with toys selected from a group of alternative choices. Results were in general agreement with the hypothesis, indicating that the degree of spatial coherence was similar in drawing and in play-constructions. Furthermore, it was found that while the 6-year-old children constructed spatially coherent representations, the 4-year-olds did not. (Author/MP)

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RELATIONS BETWEEN DRAWINGS AND PLAY-CONSTRUCTIONS IN FOUR- AND SIX-YEAR-OLD CHILDREN

Maare Tamm

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RELATIONS BETWEEN DRAWINGS AND PLAY-CONSTRUCTIONS IN FOUR- AND SIX-YEAR-OLD CHILDREN

Tamm, M. Relations between drawings and play-constructions in four- and six-year-old children. Umeå Psychological Reports No. 148, 1980. - An experiment is reported which tested the hypothesis derived from Piaget's theory of cognitive development, that the structure of children's drawings and play-constructions, being expressions of the same underlying function, should be similar. Two groups of nursery-school children, four- and six-year-olds, were given a test-task consisting of a verbally presented narrative describing an outdoor scene, then required to retell it and in different sessions to produce a drawing, to build with toys which they had to ask for, and to build with toys chosen from alternatives. In general agreement with the hypothesis, the degree of spatial coherence was very similar in drawing and in play-constructions. Furthermore, the 6-year-old children constructed spatially coherent representations, but the 4-year-olds did not.

According to Piaget mental representation stems from the semiotic function (Piaget & Inhelder, 1969). It has five separate manifestations: (1) Deferred imitation; (2) Symbolic play; (3) Drawing; (4) Mental imagery; and (5) Language. Since Piaget relates all these manifestations to a single underlying function, these five manifestations should develop together. There are, however, no data relevant to this point. Earlier studies on the development of the semiotic function have focused on one or the other of these manifestations. The purpose of the present study, therefore, is to investigate the relations among the development of different manifestations of representation. For this study drawing and play-constructions were selected.

The child's very first representative drawings most frequently consist of global, undifferentiated forms and shapes, chiefly marking the over-all qualities of the drawn objects. Both the early undifferentiated drawings and the later more complex and coherent ones must be regarded as symbols or signifiers rather than imitative copies of reality. Accordingly, the drawings do not have to show any specific likeness to what they symbolize (Arnheim, 1954; Golomb, 1974; Goodnow, 1977). The younger the child is, the more incoherent his drawings (Luquet, 1913; Kellog, 1969; Smith, 1972; Golomb, 1974; Goodnow, 1977). Children four years or younger seem to be quite insensitive to how the different parts in a drawing should be related, and they do not seem to realize the importance of drawing all the objects which make up the integral parts of the picture. The children may, for instance, draw only some of the objects, or parts of the objects while omitting others, or parts of them, despite each of the objects or their parts being equally important for the whole picture. The young child's inability to draw a coherent picture has to do with his understanding of space (Piaget & Inhelder, 1967) and also with the medium used for representation (Arnheim, 1954; Golomb, 1974). With respect to the medium, it is important to note that an analysis of young children's drawings may give quite a misleading picture of their actual representational ability, if one does not take into account the verbal context in which the drawing process takes place. Forms, shapes, "tadpole-men" and the like would be totally incomprehensible if they were not supplemented by the child's explanations of what these "signifiers" stand for. As the child grows older, his drawings become more detailed, complex and coherent. The symbolic character of the drawn objects decreases and is replaced by more realistic looking copies of reality (Luquet, 1913; Arnheim, 1954; Kellog, 1969; Di Leo, 1970; Golomb, 1974; Goodnow, 1977).

According to Piaget (1951) the symbolic play-constructions of the child change their character between the ages of four and seven. Firstly there is a progressive increase in coherence in the play-constructions and, secondly, the symbols used by the child become increasingly realistic, i.e. they are chosen so that they approximate a straight-forward imitation of reality. Before the age of four the child is unable to con-

struct spatially coherent representations, which is true in free play-observation situations without any instructions (van Wylick, 1936; Kamp, 1947) and in play-construction tasks with given instructions (Piaget & Inhelder, 1964). Only at the age of seven is the child able to construct a spatially coherent representation with adequate topographic relations between the included objects (van Wylick, 1936; Kamp, 1947; Piaget, 1951; Piaget & Inhelder, 1964, 1969).

The results described above suggest that the development of children's representations in drawing are related to those in play-construction. The similarities are pointed out both by Golomb (1974) and Goodnow (1977). Kamp (1947) and Piaget (1969) stress the correspondence between childrens' play-constructions and the Luquet's (1927) development-sequence for drawing. This is of course what Piaget's theory would lead us to expect. However, no study has directly investigated the relations between different modes of representation, using the same children. Consequently, it is not possible to ascertain what the relations between different modes are. The purpose of the present study, therefore, is to investigate the relations between play-constructions and drawings with the same children, thus enabling us to see whether these modes are related as would be expected from Piaget's theory. Specifically, the purpose is to investigate how children's representations are structured, emphasizing primarily their spatial coherence, and the way in which this structure is reflected in drawing and play-construction. For this purpose the experimental groups are tested with the same test-task, which is presented verbally.

The age groups in the study comprise four-and six-year-old children. Pilot work revealed that children below the age of four were too young to participate in this kind of investigation, because they were incapable of responding to task instructions. Children above the age of six were too advanced for the problem in question.

The hypothesis for the study may be summarized in the following way: The 4-year-old children are unable to construct a spatially coherent representation of the test-task both in drawing and in play-construction. Instead they will draw and/or arrange the objects into collections. The 6-year-old children, on the other hand, should be able to construct a spatially coherent representation of the test-task both in drawing and in play-constructions.

It is important to note that the task demands differ between drawing and play-constructions as the latter method is usually employed. In drawing, the child has to transform a verbally evoked representation into a two-dimensional graphic one. In addition, he has himself both to invent and produce the "signifiers" necessary for that purpose, i.e. he is basically given a kind of recall task. In play-construction all the representative objects (toys) are already in front of the child's eyes, and he has only to ask for those which correspond to the verbally evoked representation in his mind, i.e. he is given a kind of recognition task. To construct a representation may therefore be harder in drawing than in play-construction. To shed some light on this problem a third condition was introduced in which the subjects had to ask for toys for their constructions, rather than just choosing them from a set of visible toys. This condition is midway between drawing and the traditional form of play-construction in that it requires the subject to recall the items to be used, but does not require him to actually create as he does in drawing. The hypothesis lead us to expect that the results will be similar in all three conditions with respect to their structural properties, even though they may differ in other aspects.

Method

Subjects

Eighteen middle class children from a nursery school in Boden, a small town situated in the north of Sweden, served as subjects. Nine children (4 boys and 5 girls) with a median age of 4.6 years (3.11 - 4.10) were assigned to the 4-year-old group, another 9 children (3 boys and 6 girls) with a median age of 4.6 years (5.9 - 7.1) to the 6-year-old group.

Test-task

A narrative was used as a test-task. The length of the narrative was 320 words and reading it required about two minutes. The test-task described an outdoor scene as follows:

In the middle of the scene there was a lake. On one side of the lake there was a red cottage surrounded by a green fence. Behind the cottage were two trees. The cottage was inhabited by two children. On the other side of the lake there was a big white church. On one of the remaining sides of the lake there was a circusring surrrounded by a big wall. Inside the circus there were a number of animals. In the middle of the circus a king was seen riding a black horse and beside him the queen, riding a big elephant. The king's hobogoblin stood near the circus wall watching a monkey who was asleep on a red pillow. The queen's angel sat beside her in a small carriage drawn by a dog. In the lake there was a rowing-boat with a prince and a princess sitting in it. A big dangerous crocodile was swimming beside the boat.

Material

Sketch-pad paper and pencils were provided for drawing. The play-material included about twice as many small representative toys as were needed for the problem. In addition each child was given a rectangular piece of cardboard (80 x 60 cm) on which to build the scene.

Experimental Conditions

A mixed factorial design (age x experimental conditions) was used with the experimental conditions as a within-subject factor. The order of the three experimental conditions was counterbalanced according to a latin-square arrangement. The three experimental conditions were as follows:

1. Drawing. The subject had to make a drawing of the scene, described by the test-task, using the pencils and the sketch-pad paper provided.

2. Building by asking for toys. The subject had to build the scene, described by the test-task, on the rectangular cardboard, asking the experimenter for the toys needed for this purpose. Under this condition the play-material was kept out of sight of the subject.

3. Building by choosing toys. The subject had to build the scene on the cardboard by choosing the toys from a collection of toys, i.e. under this condition the subject had free access to the whole play-material. Since the play-material contained about twice as many toys as were necessary for performing the test-task the subjects were told that some of the toys were superfluous but could be used for other stories.

Procedure

The subjects were tested individually. In order to give the subjects an opportunity to get acquainted with the experimenter and the test-task, each subject was before the main test sessions approached on three different occasions separated by one half to one day. Each time the test-task was read to the subject. During these preliminary sessions, the experimenter also made sure that the subjects understood the concepts in the story by asking them to give definitions of the following kinds: "A church is a place where one sings, gets married, etc."; "A cottege is a little house to live in during the summer."; "A circus is a place where you have animals and/or do tricks, etc." All concepts unknown to the subjects were explained and exemplified, until they managed to define them properly.

The test sessions took place on three consecutive days, no more than 5 days after the subjects were first approached. During these, the experimenter and the subject were seated alone facing each other in a room adjacent to the common nursery hall. At the beginning of each session, the test-task was presented and the subject required to retell it, i.e. to tell all he/she could remember of the story. The subjects having difficulties retelling the story were prompted by questions like: "What happened then?"; "Was there anything else in the story?"; etc. Directly after retelling, the subject was required to perform the drawing or the play-construction. There was no time limit. The experimenter encouraged the subject to comment on every step taken in drawing or play-construction, to give his/her reasons for drawing/chosing objects not mentioned in the test-task, etc.

The subjects' retellings of the test-task and the conversation that took place between the experimenter and the subject during drawing/play-construction were tape-recorded. A typed transcript of every tape-recording, referred to below as the subject's protocol was made on the same day. In experimental condition 1 the subject's drawings together with the protocol served as documentation of his/her performance. The different objects drawn were numbered and listed at the end of the protocol. In experimental conditions 2 and 3 the test-task scene constructed with toys was photographed. The photo together with the protocol served in these cases as documentation of each subject's performance.

Dependent Variable

For each subject and experimental condition the degree of spatial coherence in representation was obtained as described below in order to provide an overall measure, which will serve as the dependent variable in this study.

Categorization scheme for the degree of spatial coherence. The scene described by the test-task was devided into three thematic groups (TG), every one of these possessing a spatially coherent structure as follows:

TG 1

A cottage surrounded by a fence with two trees behind the house.

TG 2

Alternative a: A circusring surrounded by a round wall with a number of animals in it. A king and a queen riding in the middle of the ring and an angel sitting in a carriage drawn by a dog.

Alternative b: A king and a queen riding, on their way to a circus enclosure, followed by a number of animals and beside them an angel sitting in a carriage drawn by a dog.

TG 3

A boat with a prince and a princess sitting in it floating in a lake, with a crocodile swimming beside it.

These thematic groups were divided, in turn, into simple relations of the following kinds:

(1) a cottage surrounded by a fence
    a cottage with two trees behind it

(2) a circusring, surrounded by a wall, with some animals in it
    a king and/or a queen riding an animal
    an angel sitting in a carriage
    a dog drawing a carriage

(3) a prince and/or a princess sitting in a boat
    a crocodile in the lake
    a boat in the lake

The rest were considered as "isolated objects".

The degree of spatial coherence in representations was defined in terms of the following hierarchical classes:

Class 1 - includes all isolated objects, drawn or toy-objects, randomly placed beside each other and/or mixed with pairs of interrelated objects of the type called "simple relations" described above.

Class 2 - includes both isolated object and related ones, i.e. all that can be considered to belong to class 1. In addition, it has to include one optional TG of the three TGs described above.

Class 3 - includes class 1 above and two of the three TGs described above.

Class 4 - includes all three TGs, ordered in a juxtaposed manner, i.e. without considering their correct spatial positioning.

Class 5 - respresents a totally coherent representation of the test-task.

Scoring procedure for the degree of spatial coherence. Inspection of the data showed that there were some incorrect objects, i.e. objects not mentioned in the story, in some of the representations. When calculating the degree of spatial coherence, no attention was paid to the existence of those. The material on which the calculation was based in drawing comprised: the subjects' drawings, the lists of drawn objects, and the subjects' protocols. In building by asking for toys and building by choosing toys, the photos of the end-products together with the subjects' protocols were used. Two independent raters made the classifications, the inter-rater agreement being 89 % for the 4-year-old group and 100 % for the 6-year-old group. In cases of disagreement, the author's classification was final.

Table 1. Number of subjects in each age-group attaining different degrees of spatial coherence in retelling a test-task after the first, the second and the third presentation.

	Age-group					
	4-years-old			6-years-old[1]		
Presentation order	1st	2nd	3rd	1st	2nd	3rd
Degree of spatial coherence						
Class 1	3	5	4			
Class 2	6	3	4			
Class 3			1			
Class 4				2	3	2
Class 5		1		7	6	6

1) One subject could not be motivated to take part in the last session, which in his case was drawing.

Results

Degree of spatial coherence in retellings

By way of comparison, the degree of spatial coherence in retellings after the first, the second and the third presentation of the test-task was calculated in the same way as for drawing and play-construction but with objects replaced by words. Numbers of subjects attaining different degrees of spatial coherence in the different age groups are given in Table 1. As can be seen, the degree of spatial coherence is much higher in the 6-year-old children than in the 4-year-old children. Furthermore, there is no indication that the degree of spatial coherence changes across presentations.

Table 2. Number of subjects in each age-group attaining different degrees of spatial coherence in drawing, in building by asking for toys, and in building by choosing toys.

	Age-group					
	4-year-olds			6-year-olds		
Experimental condition	Drawing	Building by asking for toys	Building by choosing toys	Drawing	Building by asking for toys	Building by choosing toys
Degree of spatial coherence						
Class 1	4	2	5			
Class 2	5	4	4			
Class 3		2				
Class 4				1	1	1
Class 5		1		7	8	8

Degree of spatial coherence in drawing and play-constructions

As revealed by Table 2, which shows numbers of subjects in each age-group attaining different degrees of spatial coherence in drawing and play-constructions (building by asking for toys and building by choosing toys), there is the same degree of spatial coherence in both drawing and play-construction in the 6-year-old children. In the 4-year-old children the representations in building by asking for toys are somewhat more coherent than those in drawing and in building by choosing toys. As can also be seen, the degree of spatial coherence is much greater in the 6-year-old children than in the 4-year-old children; in the former group, all subjects fall in the two highest classes of spatial coherence, in the latter they fall in the three lowest classes with virtually no overlap between the age groups.

In order to shed further light on the question whether the degree of spatial coherence is similar in drawing and play-construction, Table 3 shows number of subjects in each age group attaining the same degree of spatial coherence in all experimental conditions. By way of comparison, the same data are given for retellings after the first, the second and the third presentation. As can be seen, nearly all subjects in the 6-year-old group attain the same (high) degree of spatial coherence in all retellings and experimental conditions, whereas in the 4-year-old group only 4 and 2 subjects, respectively, fulfil this criterion.

Table 3. Number of subjects in each age-group attaining the same degree of spatial coherence in all retellings and in all experimental conditions (drawing, building by asking for toys and building by choosing toys).

	Retellings	Drawing/ play-constructions
Age-group		
4-year-old	4	2
6-year-old	8	7

Discussion

The results of this investigation are in general agreement with the hypothesis that drawings and play-constructions are expressions of a unitary underlying function of symbolic representation. As far as the 6-year-old group is concerned, the results show that there is a high degree of similarity in the structure of spatial representations in drawing and play-construction. That is, the 6-year-old subjects were able to construct spatially coherent representations of the test-task, both in drawing and play-construction, and their representations were similar in both kinds of conditions. In the 4-year-old group, on the other hand, the representations did not have much coherence in either drawing or play-construction. That is, the 4-year-old children were not able to construct spatially coherent representations of the test-task in either experimental condition. This is in line with earlier findings (van Wylick, 1936; Kamp, 1947; Piaget & Inhelder, 1964, 1969; Golomb, 1974; Goodnow, 1977; Freeman, 1976). For both age groups, the degree of coherence thus tends to be similar in drawing and play-construction, indicating that there is an underlying common function. However, the two age groups differ in the overall degree of coherence, indicating that this function is less developed in the four-year-olds than in the six-year olds.

A comparison of the different recall and recognition conditions in play-construction revealed that the visual accessibility to the play-material did not affect the representational structure in either age-group. Thus, the different task demands did not seem to affect the subjects' performance.

To understand the subjects' representations it proved necessary to follow the whole representation process, including the subjects' comments. Considering only the end-products, i.e. the drawings and the constructions, there was hardly any coherence at all among the 4-year-old subjects' representations, which, moreover, comprised a mixture of correct and incorrect objects, i.e. objects not mentioned in the test-task. These

were randomly drawn on the paper in drawing and placed all over the cardboard in constructions. Similar observations have been made by others (van Wylick, 1936; Kamp, 1947; Golomb, 1974; Freeman, 1976; Goodnow, 1977).

Although the present results are in accordance with previous findings, they do not explain why the 4-year-old subjects' representations have such a low degree of coherence. There are at least two alternatives to the hypothesis that the 4-year-olds constructions and drawings express a lower degree of development of the semiotic function. First, it may be that the test-task was too demanding, containing 24 items, or that the scene described by the test-task was too unfamiliar to the 4-year-old subjects. If so, the subjects' failure to represent the test-task in a coherent way is a problem of method. This aspect may be investigated by replacing the test-task with an easier one. Second, it may be that the external manifestations of the semiotic function have not yet reached beyond the field of the 4-year-old childrens' spontaneous activity. In this case it could be considered as a problem of "decalage". To investigate this calls for careful studies both of the process and product of development. Both problems need to be studied in future research.

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